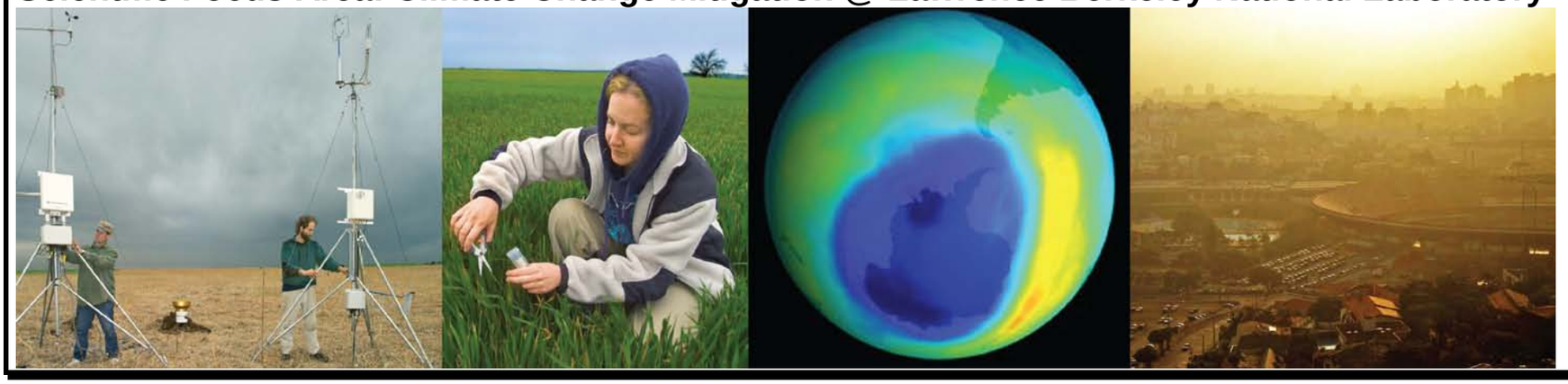
Scientific Focus Area: Climate Change Mitigation @ Lawrence Berkeley National Laboratory



Basic research into mechanisms of soil carbon turnover, storage, and loss will produce fundamental knowledge needed for predicting the influence of soil on atmospheric CO_2 concentrations through sequestration or ecosystem-climate feedbacks. This is important because soil carbon turnover, storage and loss control the rate at which carbon builds up in soil or is returned to the atmosphere as CO_2. Our research uses a combination of field and laboratory experiments and advanced analytical techniques, leveraging our team's expertise in natural abundance ^{14}C and isotopically labeled substrates, advanced imaging, and microbial expertise. We apply these tools in an integrated program to study three components of soil carbon cycling:

- **Microbial decomposition of litter and formation of soil organic matter (SOM).** In 2001, we placed $^{13}C/^{15}N$-labeled roots and needles in forest soils. We will use the 5-year and final 10-year collections to investigate the influence of litter type, soil depth, and microbial community on decomposition pathways and stabilization.
- **Black carbon degradation.** We initiated a black carbon field study, starting in summer 2009, which will be the first to directly quantify black carbon degradation rates *in situ* and identify black carbon decomposers.
- **Organo-mineral associations and long-term SOM stabilization.** We will build a practical bridge from molecular mechanisms of carbon stabilization to field-scale models. We will examine the interaction between mineral reactivity and carbon-compound chemistry, and test the hypothesis that pH is a useful single-value predictor for complex suites of physico-chemical controls of soil carbon stabilization.

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